Autism-friendly architecture from the outside in and the inside out:

An explorative study based on autobiographies of autistic people

Marijke Kinnaer, Stijn Baumers & Ann Heylighen

Abstract

Researchers and designers each developed a particular vision on autism-friendly architecture. Because the basis of this vision is not always clear, questions arise about its meaning and value, and about how it can be put to use. People with a diagnosis on the autism spectrum are central to these questions, yet risk to disappear from the picture. Refocusing the discourse about autism-friendly architecture on them is the aim of the explorative study reported here. Six autobiographies written by autistic (young) adults were analysed from two different viewpoints. First, concepts from design guidelines concerning autism-friendly architecture were confronted with fragments from these autobiographies. The second part of the analysis started from the autobiographies themselves. This analysis shows that concepts can be interpreted in multiple ways. They can reinforce but also counteract each other, thus asking for critical judgment. An open space is preferred by some autistic people because it affords having an overview, which increases predictability, and distancing oneself from others without being isolated. Others might like this space to be subdivided into several separate spaces which affords a sense of structure or reduces sensory inputs present in one room. The six autobiographies provide a glimpse of autistic people's world of experience. Analysing these is a first step in revealing what architecture can actually mean from their point of view. For them, the material environment has a prominent meaning that is, however, not always reducible to design guidelines. It offers them something to hold on to, relate to or structure their reality.

Keywords: architecture, autism, autobiographies, design guidance, lived experience

1. Introduction

Autism—from the Greek word *autos* meaning self—denotes a spectrum of conditions related to "social communication and interaction", and "repetitive patterns of activities and interests" (APA, 2013). The term was first used by Kanner (1943) and Asperger (1944) to describe a group of children, seemingly living in their own private worlds and combining a great ingenuousness with a fundamental lack of knowledge about social interaction (Delfos, 2005). Subsequently, autism became known as an affective disorder, following hypotheses like Bettelheim's (1976), who blamed supposedly unloving parents for their children's condition (Wing, 1997). Because autism could not be formally diagnosed, many autistic children, then labelled schizophrenic (Wing & Potter, 2002), lived in institutions unfit for them or the parental home. Either way, they often got excluded from society (Ahrentzen & Steele, 2009).

In the mid-1960s, hypotheses were replaced by well-founded theories explaining what autism is about: a difference in information processing with a neurobiological cause (Rajendran & Mitchell, 2007). These theories united parents to fight for their children's rights, including better education and living circumstances. As a result, attention shifted from large institutions outside of the community to smaller domestic living arrangements within (Braddock et al., 2008, Venderbosch, 2008, Ahrentzen & Steele, 2009, Brand, 2010).

Today we talk about a much wider autism *spectrum* (APA, 2013), because autism-related conditions have been found to occur in a continuum of different forms and gradations. This might explain the variety among autistic people today, ranging from people needing continuous help to people living and working independently who can tell us about autism from the inside out.

But what is the relevance of considering autism for designers? Several researchers examined the relationship between architecture and its users. Coolen (2006, p.188) suggests that an object's "meaning exists in how the individual designates the object, and in this sense an object may have different meanings for different human beings." Coolen was inspired by Gibson's (1979) notion of

"affordance", which denotes the possibilities of use or choice of actions embedded in an object or environment and noticeable by people. Gibson (1979, p. 127) introduced it to describe what an object offers someone, "what it provides or furnishes, either for good or for ill." For Gibson, this is always relative to the action potential of a particular "actor" – a person or group of people who performs an action.[1] A horizontal cantilevered surface, for instance, may afford support to one person and not to another due to differences in stature or weight. Designers' challenge is to anticipate the use and actions an environment induces, which makes affordance a valuable concept for design. "Obviously," Maier and Fadel (2009, p.389) state, "buildings must be designed to afford desired uses to its occupants and other stakeholders." Including the concept of affordance in the design process could help designers to deliberately think about people's possible interactions in response to their designs. In the context of inclusive design, researchers explored the design of environments that account for this diversity of possibilities and capacities. The earliest studies focused mainly on physical accessibility and less on sensory difficulties, let alone mental and cognitive conditions (Mostafa, 2007). Nevertheless, these conditions raise similar questions. Because of the difference in information processing, autistic people deal with their environment in a unique way, which influences their spatial experience and interaction with the surrounding world. Questions thus arise as to whether designers can design environments that autistic people experience as more enjoyable by taking into account their experiences and problems, and what elements the design should include.

The variety of writings addressing autism-friendly architecture suggests that these questions are difficult to answer. Given the diversity among autistic people, it is not always clear which subgroup is being considered. Early articles on this matter therefore focused on the importance of user-interaction (Mostafa, 2007). Yet, when autism-friendly projects are developed, future users are not always known or fixed. This does not mean that their expertise cannot be useful, however. Much knowledge was and is present in projects designed for autistic people, their experiences, and those

of their caregivers, teachers and parents. Several methods are used to gather and organize this knowledge, depending on the study's purpose and the researchers involved.

A first group of studies start from existing literature to formulate new hypotheses and concepts, which are then tested quantitatively with experiments and interventions (Mostafa, 2007, Khare & Mullick, 2009). To formulate new hypotheses, literature is often complemented by observations or interviews. A second group of studies spring from design projects (Whitehurst, 2006, Scott, 2009, Williams & Boult, 2009, Beaver, 2011). When the outcome is evaluated afterwards through "feedback studies" or "post occupancy evaluations" and the results are published, it can become an important information source for others. Unfortunately, designers are often unfamiliar with autism-friendly architecture, and lack the time and possibilities to investigate related studies and projects extensively. Therefore Ahrentzen and Steele (2009) and Brand (2010) each developed a "Design Guide" to give designers a first impression of autism-friendly architecture. They explain the difficulties autistic people encounter, formulate general goals, and specify these in several design guidelines.

Step by step, researchers and designers each thus developed a particular vision of autism-friendly architecture, resulting in a continuously expanding number of recommendations and design guidelines about this topic. Because it is not always clear what these are based upon or how they were produced, questions arise as to what their meaning and value is, and how they can be put to use. The concepts advanced in these design guides do not apply to everybody to the same extent. Autistic people, as individuals and end users, are central to these questions, yet risk to disappear from the picture. Therefore we conducted an explorative and interpretive study that aims to do the exact opposite: to refocus the discourse about autism-friendly architecture on autistic people. To this end, we addressed the following research questions: what concepts are advanced to design autism-friendly environments? And to what extent do these concepts appear in autistic people's experience? After presenting the methods and material used, we report on how these allowed us to gain a more nuanced understanding of what architecture can actually mean from an autistic point of view.

2. Methods and material

Our study started from how autistic people—themselves—think about and reflect on their interaction with space. Since disabled people tend to experience a tension between personal values—shaped by their personal experiences with disability—and the general values of larger society (Albrecht, 2003), we wanted to emphasize autistic people's personal values, drawing attention to their personal accounts of the material environment.

Gaining access to autistic people's experiences and thoughts is not trivial, however. Although autism includes a wide spectrum of disorders and capabilities, impairments in social interaction and communication are common characteristics of this spectrum (Wing, 1997, Noens & van Berckelaer-Onnes, 2004, APA, 2013). Nevertheless, some autistic people find a way to express their thoughts and feelings by writing (Klonovsky, 1993). Some write in detail characteristic memories of their life, others share their experiences and feelings in letters, diaries or leaflets (Baumers & Heylighen, 2010). Several have written down their experiences in autobiographies, ranging from internationally known speakers like animal science professor Temple Grandin to people who do not even talk in everyday life like Jasmine Lee O'Neill. These written accounts offer a way to express themselves and share things they cannot share otherwise. Moreover, they provide an abundance of expressive fragments about concrete situations from daily life. Framed within the autobiographers' life history, they allow for a nuanced understanding and can help uncover a different kind of knowledge.

Our explorative study used published autobiographies of autistic people as a particular source to analyse the importance of the material environment, its interpretation and the corresponding way of dealing with it. We selected six such accounts based on the following criteria: they are written in English or Dutch, by autistic people themselves (not by a relative), about experiences of their own lives (including the physical space in which it takes place), and cover a diverse group of (young) adults living in various circumstances. The selection included the autobiographies by Gunilla Gerland (1996), Dominique Dumortier (2002), and Liane Holliday Willey (1999). While these three adult women each were diagnosed with autism only at a later age, they

describe their entire life history until today. We also selected a book that is conceived as a correspondence between Loes Modderman and Landschip, a middle aged autistic man who tells in a comprehensible way about his experiences, including his special living situation, difficulties in his work environment, and his holding on to habits, routes and more. The books by Temple Grandin (1995) and Jasmine Lee O'Neill (1999) describe the authors' personal story, and their thoughts about autistic people in general, be it often illustrated with fragments from their own life, which is what we focus on here.

The selected accounts were analysed starting from two different angles: from the outside in and from the inside out. First, we confronted several design guidelines concerning autism-friendly architecture with fragments from the selected stories, not to confirm or contradict them, but to provide a more nuanced understanding of the information offered. To this end, we identified the common concepts underlying these guidelines, and used these as a framework to analyse the accounts.

In analysing qualitative data, however, using a preconceived framework runs the risk of excluding alternative, more illuminating ways of organizing the data (Dierckx de Casterlé et al., 2012). This may lead to premature analytic closure, resulting from a persistent (but often unconscious and unrecognized) commitment to some a priori view of the subject under investigation, *c.q.*, the notion of autism-friendly architecture. Therefore, the second part of our analysis started from the autobiographies themselves, to obtain a glimpse of the world of experience of autistic people from the inside.

To this end, the accounts were reread thoroughly, concrete experiences were indicated in the texts and tagged with themes. A theme list was drawn up for all autobiographies and relevant fragments were linked to these themes. Themes were analysed across different accounts and substantiated with quotes from the texts. Discussions of themes and quotes among the three of us enhanced the possibility to grasp the essence of the autobiographies, correct misinterpretations and

obtain well-considered insight into the research phenomenon. Quotes originally written in Dutch were translated to English by ourselves.

3. From the outside in

In trying to refocus the discourse on autism-friendly architecture on autistic people, we first inventoried themes and concepts found in literature (see Table 1), starting from the different groups of studies discussed above (see Introduction). Subsequently, we confronted these with fragments from the autobiographies.

Sensory accessibility	**Mental accessibility**	**Independence & self-esteem**	**Safety & wellbeing**
Sensory room Escape space / privacy Clarity and order Colours and patterns Natural daylight Sounds from outside Enclosure	Predictability: transparency, overview Consistency Comprehensibility Controllability: personal space, exits Orientation & navigation	Self-dependence Individuality Independence	Safety Robustness Controllability

Table 1: Themes and concepts found in literature on autism-friendly architecture

3.1 A deeply sensory world

The first theme addresses the lack or overload of sensory stimuli, and how these can distract or cause overpressure in autistic people. Their unique sensory experiences play an important role in their perception of the environment. Three types of sensory difficulties can occur for each of the senses (Delacato, 1974): hypersensitivity, hyposensitivity and internal interference. Hypersensitive individuals experience difficulties in processing even modest levels of light, colours, smells or textures—e.g., a zooming refrigerator or flickering light bulb— causing considerable stress, whereas hyposensitive people specifically look for these same stimuli in, e.g., bright colours or sound reflections (Bogdashina, 2003). Grandin (1995, p.76) explains internal interference or “white noise” as follows*:*

> “It is likely that such a person has no idea of his body boundaries and that sights, sounds and touches are all mixed together. It must be like seeing the world through a kaleidoscope and trying to listen to a radio station that is jammed with static at the same time.”

To address these sensory challenges, creating a neutral and consistent environment is often advised. Rather than about environments that are cold and impersonal, designers should think about creative solutions to reduce and add stimuli as needed (Brand, 2010). This advice induced two concepts for recompensing a lack or overload of sensory stimuli: sensory rooms and escape spaces. **Sensory room**s offer various multi-sensory experiences through textures, light, colours, sounds etc. Sometimes such places exist without being designed on purpose, as Dumortier (2002, p.47) illustrates: *"*Each time I go to the movies, I lose myself in the changing colours on the walls. (…) These colours fascinate me.(...) Sometimes I go to the movies because of those colours, rather than because of the movie.*"* This peaceful and consoling feeling can come from many different sources. Landschip experiences it while painting:

> "The painting springs from a motor process in which I produce lines, colours and forms just because of the pleasant feeling they give me during painting. (…) they change the sad feeling into something better. (…) all my mental activity shuts down (…) as a kind of break" (Landschip & Modderman, 2004, p. 133-6).

Landschip's daily portion of painting gives him the necessary sensory input and, therefore, could be considered as his personal version of a sensory room.

The second concept, an **escape space**, is a safe place where one can retreat from too demanding situations, offering the necessary sense of control and safety. It does not have to be a little sterile space, which might even frighten some people (Vogel, 2008). It can just as well be a small corner inside someone's home, Gerland (1996, p.16) illustrates: *"*My consolation, my safe retreat in the world, was a brown armchair in one corner. I could just fit in behind it." Sensory rooms and escape spaces thus seem to complement each other. The right sensory stimuli can bring comfort and peace, yet what comforts one arouses the other.

Besides these general concepts, each of the senses separately serves as a footing for specific design guidelines. Difficulties in processing visual stimuli might increase autistic people's

susceptibility to certain **colours**, **patterns**, or **lighting**, and in more severe cases, cause them to see the world as a fragmented 2D picture (Grandin, 1995, Bogdashina, 2003). Therefore, they need environments that display a great sense of **clarity**, space and **order** (Brand, 2010), including sufficient storage space, preferably integrated in e.g., partition walls (Vogel, 2008). Some autobiographers indeed feel the need to put everything out of sight, whereas others enjoy displaying their special collections. Landschip developed his personal minimalistic strategy to deal with this:

> "I don't own a single cupboard, just four small shelves which ensure that the few things I do have are always visible. If I put things in cupboards, I'd simply forget I have them. I don't have a refrigerator, a stove, a washing machine or even a bed, just the absolute minimum of furniture, all fold-up. I sleep in a sleeping bag which I put away each morning and my clothes are in a trunk" (Landschip & Modderman, 2004, p.15).

Too many decorations and details might also provide irrelevant stimuli, demanding attention that cannot be used for actual tasks. Still, an environment should feel welcoming, as Landschip testifies when describing his visit to a sheltered house:

> "The life in that home was reduced to nothing but efficiency. When they guided me around the house, there was nothing that showed me that there were already four people living there. No sign of someone's personality…nothing. Just rooms filled with sterile furniture and a feeling of neatness. It was frightening" (ibid., p.43-44).

Landschip notices that, for him, a difference exists between stimuli from "useful objects", which he cannot bear, and those from his paintings, which he perceives as pleasant. *"*My whole living room is filled with paintings, it looks like a permanent exhibition*"* (ibid., p.16).

As with visual features, autistic people can also be either attracted or sensitive to certain **sounds**, especially mechanical ones (e.g., a ventilation system). Therefore, acoustic criteria should well exceed existing minimum standards, both for sounds coming from outside, and for

reverberation times. Some autistic people have difficulties to distinguish between foreground and background noises. Even the smallest sound can repress everything else but cannot always be repressed itself. Dumortier (2002, p.55) recounts a lecture in a big room with excellent acoustics and a well articulating speaker who talked clearly through the microphone. Nevertheless, she still could not follow it: "I couldn't focus on her voice because another sound was dominating everything. A couple of tables behind me someone was clicking his pen, very slowly. For me, this sound was as much present as the speaker's voice." For this reason, an intensive compartmentalizing of spaces is often suggested.

This brings us to the sense of touch. When the other senses fail to give an accurate representation of reality, the way things feel becomes even more important (Grandin, 1995). Therefore, materials and textures are well-debated in relation to autism. However, the feeling of **enclosure** is as important to emphasize. Mostafa (2007) recommends small intimate spaces for quiet activities. In several of the accounts, autistic people indeed talk about their fondness of tents and cabins, or mention crawling into narrow spaces, in search of the pleasant feeling of pressure. Landschip slept in a sleeping bag in a tent in his living room because of the feeling of shelter it gave him (Landschip & Modderman, 2004). Gerland (1996, p.105) liked it when she fitted exactly into a small cramped space:

> "It was the same feeling that meant that I usually found myself under or in between things. (…) At sleep time it was best if I could get father to fold the mattress round me, then fasten the sheet firmly around it."

3.2 A mentally challenging world

The second theme addresses the fact that, for autistic people, reality can be terribly chaotic and unpredictable. For this reason, the material environment should be **predictable**, **consistent**, **comprehensible** and **controllable**. Lee O'Neill (1999, p.80) describes this phenomenon as follows: *"*An autistic person is confused by other people's actions. She is disturbed by their unpredictability.

Any time that you respond to, approach, or deal with another, you don't know what that other will do." Whence the importance of personal space, psychologically as well as physically (Ahrentzen & Steele, 2009). This should not be translated as: "autistic people want to be alone," however. It is a delicate balance, as Landschip illustrates:

> "Although I was glad they were here, I'm just as glad that they are gone and I'm alone again in all quietness. (…) I love someone coming over, but each time I experience it as a field of tension: wanting to be around other people but not being able to cope with it" (Landschip & Modderman, 2004, p.153).

A compromise is to provide a range of spaces, allowing for different kinds of social interaction (Ahrentzen & Steele, 2009). Communal rooms, specifically meant for social interaction, should be designed as ample spaces, taking into account that autistic people's feeling of being crowded might not correspond to the designer's. When socially demanding situations become too overwhelming, it should be possible to retreat to a more sheltered space, e.g., a subtle alcove at the edge of the room, a plateau on a slightly different level, or even a completely separated (escape) space (Vogel, 2008). To increase the feeling of controllability, Ahrentzen and Steele (2009) recommend foreseeing enough exits to leave a place. But the opposite is important too. In an open plain, everything becomes possible, and every feeling of controllability is missing. Dumortier (2002, p.62) testifies:

> "I don't like to find myself in an open plain – certainly not in crowded places, such as a marketplace, nor in calmer places, such as a meadow. When I'm standing in the middle of such an open space, I have to keep an eye on to many things at the same time. Sudden movements can occur unexpectedly, all over the place, and each time, I try to prepare for them, but it never works."

For this reason, some autistic people might not like to sit in the middle of a big room. These challenges should all be addressed when deciding on spatial configuration.

When designed carefully, the built environment can also provide autistic people with something to hold on to. As Grandin (1995, p.76) points out, "[r]eality to an autistic person is a confusing interacting mass of events, people, places, sounds and sights. There seem to be no clear boundaries, order or meaning to anything." To deal with this chaos and unpredictability, autistic people tend to need structure in space and time, through schedules and routines. Mostafa (2010) recommends to foresee a place for everything and let everything happen in its place. This place, in turn, should be specified according to that particular activity. Dumortier (2002, p.88) experiences this need throughout her life:

> "Each activity has its own place, even at home. These fixed places provide me with the safety and structure which is so essential to me. (…) I always need to have dinner at the table. Even if I eat in front of the TV or couch once in a while, I get in trouble. Nothing seems clear anymore and inevitably, the day will come that I just don't want to eat anymore (…) because eating no longer has a fixed place. (…) If this happens with several things at once, my life becomes almost unliveable."

Activities thus can just as well be linked to parts of spaces, or even objects therein.

> "I placed a mattress in the corner of my living room. During the day, I often use this to lie down. In daytime, I can't rest in my bed, cause a bed is meant to sleep at night. (…) Since I put that mattress in the living room and allow myself to rest during the day, I'm much better" (Dumortier, 2002, p. 43).

Different activities can happen in one room, as long as each has a clearly defined context. Yet, autistic people may encounter problems also in remembering and completing several succeeding tasks (Rajendran & Mitchell, 2007).

> "When my fixed pattern is interrupted, life suddenly gets harder. It seems like I don't remember how to do even the simplest things. When I'm refreshing myself in the morning,

and I get interrupted by the telephone, I experience a great resistance in continuing the task" (Dumortier, 2002, p.88).

Designers can try to anticipate these difficulties by organizing space in a sequential way, reflecting daily routines, and attending to sensory and functional zoning (Mostafa, 2010).

Also on a bigger scale, the organization of buildings and environments should be attended to. Several autobiographies suggest that **orientation** and **navigation** are sometimes less developed skills in autistic people, which can present itself at different scales (Gerland, 1996, Willey, 1999, Dumortier, 2002, Landschip & Modderman, 2004).

> "It is embarrassing to admit to people (…) that I cannot find my way out of a mall or down a series of hallways in an office building, or that I cannot even easily find my way home in my hometown. (…) I hate seeing the world as a distorted nightmare made up of secret passageways, false exits and trap doors" (Willey, 1999, p.68).

Considering some autistic people's problems to understand a street plan, Vogel (2008) suggests to think about architectural elements which can actually help them to orient themselves in space, referring to tools advanced by Lynch (1960). Lines can be provided by creating clear circulation patterns, not just by marking them with coloured tape or footsteps but rather by paying attention to straightforward circulation, if possible accompanied by memorable edges like curved or half walls. The nodes Lynch describes can be designed as landmarks (like sculptures or fountains) or as noticeable junctions, by marking them with say a patio. Finally, using colour-coding can create zones or districts. Willey (1999, p.48-9) deliberately used such elements to find her way around campus, but once inside the buildings they were missing, making it extremely difficult for her to navigate.

> "I would look for big landmarks like statues or unique pieces of architecture and then plot a visual map anchored by those sites. (…) For example I knew that when I left the building my Shakespeare class was in, I would come to either a fountain, a street or a parking lot. (…)

> Once inside the buildings I had a heck of a time finding my way around. Normally I had to rely on trial and error unless the interiors had their own landmarks – art work, display cases, unusual paint schemes – I could use as visual cues. Most of them did not, relying instead on the same plain beige walls dotted here and there by identical looking bulletin boards that did nothing to help me out."

3.3 Independence and self-esteem

The third theme draws attention to aspects fostering growth and development (Brand 2010).
The potential for **self-dependence** starts with the choice of one's neighbourhood. Many autistic people have difficulty or are unable to drive a car (Ahrentzen and Steel 2009). Dumortier (2002, pp.28-35) testifies that more stimuli need to be processed, while traffic is very unpredictable and the rules are regularly broken. Willey (1999, p.52) loved her position at the university except for one aspect: every day she had to drive to the campus in an overcrowded area, got lost somewhere, and eventually arrived completely stressed: "A nightmare I had to contend with day in and day out." Whence the importance of living in the vicinity of public transport (Ahrentzen and Steele 2009). Taking a bus or train can be big enough a challenge already, as Landschip describes:

> "Strange people around me so that my bodily boundaries are affected, and because of the buzz and noise I lose my visual hold. I must concentrate very well to keep knowing and understanding that I'm seated in a train and where I'm going. If the fear strikes I want to get off, which is obviously impossible when a train is riding. In such circumstances it requires an enormous effort from me not to lose my self-control" (Landschip & Modderman 2004, p.165).

A clear, simple and safe connection between one's home and facilities for work, education, healthcare and leisure may help to avoid this kind of situations. Identifying and mapping clear trajectories for certain goals might help too (Ahrentzen & Steele 2009). Dumortier (2002, pp.28-35)

has a fixed number of destinations in the neighbourhood (youth movement, her friends, one bakery, a few shopping addresses) to which she always takes the same routes. When using public transport, she always takes the same buses and trams at the same stop, even if this implies a detour. If the neighbourhood is selected carefully, many places can be reached without help and social networks, interests and skills can be developed (Ahrentzen & Steele, 2009).

The ultimate sign of **independence** is having an own apartment or house (Brand, 2010). For some autistic people, however, this might come with stumbling blocks (Ahrentzen & Steele, 2009). Maintaining a house, and doing daily tasks (cooking, laundry) is not always trivial. Hence the advice to furnish one's home such that it can be used in a structured and organised way, and to choose materials that facilitate maintenance. Also important is affordability (Brand, 2010, Ahrentzen and Steele, 2009). According to Lee O'Neill (1999, p.68), "[i]n many instances the stress of regular big world lives, and the restrictions of jobs and dealing with people are too much for the autistic individual to handle." By consequence, autistic people often must make do with what they have, i.e., try and adapt an available and affordable house to their needs.

3.4 Safety and wellbeing

The fourth theme broadens the concept of **robustness** advanced by Brand (2010): "keep residents and staff safe in a robust environment that is tolerant of unintended use." Also Beaver (2011, p.7) mentions it, yet immediately adds that keeping environments homelike is important too.
Some autistic adults regularly suffer from health problems, making them more sensitive to environmental conditions (Ahrentzen & Steele, 2009). Sleep problems, also frequently observed within the autism spectrum, may lead to fatigue and strengthen these sensitivities (Brand, 2010, Ahrentzen & Steele, 2009). The concepts regarding sensory and mental accessibility may help to improve autistic people's mental wellbeing. However, their physical wellbeing should not be neglected either.

Given this heightened sensitivity, Lee O'Neill (1999, p.89) is not surprised that many autistic people develop allergies and asthma. Brand (2010) recommends using building materials, furniture and finishes that are free of toxic substances and chemicals, do not emit gases (as some carpets and foams do), and do not hold too much dust. Places were dust can pile up are to be avoided. This is all the more important for children, who may explore environments by tasting, smelling and touching. The tendency to grasp things may have other unpleasant consequences.

> "Until my puberty, I also had the tendency to grasp everything because seeing didn't provide me enough information. Perhaps that passed due to bad experiences, such as burning my fingers and receiving electric chocks. I believe that it's a tendency I consciously learned to suppress out of self-preservation." (Landschip & Modderman, 2014, p.108)

Moreover, some autistic people do not feel coldness or warmth (Bogdashina, 2003). With her eyes closed, Dumortier (2002, p.45) needs considerable time to feel whether an ice cube is warm or cold, which affects her **safety**: "While cooking this is very unpleasant and I often burn myself quicker too. Sometimes I hold my hand too long under hot water because it takes too long before I realize that the water is hot." For this reason several authors recommend regulating the water temperature in sinks, bad tubs and showers, and using underfloor heating instead of radiators (Brand, 2010, Sánchez et al., 2011)

Some autistic people's 'forgetfulness' may come with certain risks too. If one has difficulties in switching attention, interrupting certain activities may result in a stove not being turned off, or a tap left running (Brand, 2010). Landschip regularly forgets to turn off the coffee machine. He attached think notes to a ladder, topped by the message "coffee machine off". Yet, after a while, he becomes immune for it again and has to replace it (Landschip & Modderman, 2004, p.134). Brand (2010) therefore recommends installing an efficient fire alarm, and automatic regulators for energy provision in each room and individual kitchen appliances.

A final point of attention regarding safety, not mentioned explicitly in design guidelines, is that some autistic people lack depth perception, which is required for using a staircase or step. Dumortier (2002, p.57) testifies:

> "I do have difficulty with transitions. Suddenly a step doesn't go well. I can't see well how high or how deep it is and often have to hold tight. It's as if my depth perception is limited. In this way I also have to hold tight each time I want to climb or descend the stairs. Especially descending is difficult. I must look where I put my feet because I don't see how high the steps are."

Similarly, some autistic people may have difficulty estimating distances or speeds (Wolfe et al., 2009). Gerland (1996, p.75) illustrates how this puts her at risk in traffic.

> "I had always made large detours in order to find a crossing with traffic lights on not entirely car-free streets. I never could estimate how fast cars were driving if I had to cross. (...) Each time I wanted to cross the street and there were not traffic lights, I had to concentrate to the limit in order to estimate how far the cars still were, and at what speed they were approaching. For safety's sake, I sometimes was standing still for a very long period until nowhere near a car was to be found. If possible I waited until someone else crossed and trusted completely the judgment of others."

According to several authors, some autistic people may be – deliberately or not – hard on materials, appliances and furniture. On the one hand, this may refer to the tantrums observed on the autism spectrum (Khare & Mullick, 2009). On the other hand, certain environments do lend themselves to intense movements (jumping, running, bouncing) that are not always desirable and safe (Ahrentzen & Steele, 2009). This kind of behaviour affects a building's durability, but also the safety of the person him/herself and others (Brand, 2010). Landschip still recognizes it in himself, but learned to cope with it.

> "As a child, I could have very ugly outbursts of anger, in which I kicked and smashed all kinds of things. Sometimes, out of pure frustration, this anger turned to me. This short-temperedness has never passed off, but I avoid situations in which I get angry as much as possible, and I can also canalize this anger much better now. [...] In the past, I also broke all kinds of things, and continually had a broken arm or sprained foot, and I was often injured. From the age of 15 on, I got some insight in the connection between my impulsive reactions and their consequences, and then I learned to adjust step by step. Many autists miss the capacity to evidently find this connection; luckily the longer I lived the more I learned. In my case that impulsivity mainly came from the fact that I could never accept and remember patterns just like that, and trust them. I had to figure out everything myself. That I broke so many things had to do with finding where the boundaries were, for instance: when does a window break? How hard can you tap at it for it breaks? What is tapping softly and what hard? These were for me, as a child, incredibly abstract things that I couldn't believe without testing them myself" (Landschip & Modderman, 2004, p.75).

Whence recommendations to design environments such that they can resist unintended use, are durable, and easy to maintain. These may range from using brick with impact-proof plasterboards (Brand, 2010) and fortified windows with layered glass, over choosing durable paints and easy-to-maintain wall or floor furnishes, to firmly anchoring all kinds of appliances (Sánchez et al., 2011). Environments can also be designed to protect the person, e.g., through the use of soft surfaces (Brand, 2010).

Terms like durable, robust and easy-to-maintain are quickly associated with clean, impersonal environments (Beaver, 2011). This is how Landschip experienced the sheltered house he visited: "It was terrible: everything was arranged from a to z. I'd die there in no time. I love fixedness and a predicable structure, but it has to be my own order and structure" (Landschip & Modderman, 2004, p.99). The need for robustness should thus be balanced to create aesthetic, comfortable and

homelike environments (Beaver, 2011). Instead of durable materials that are expensive to replace or restore, and create an unpleasant atmosphere, Beaver (2011) recommends warm and friendly materials that are cheaper and easy to replace or restore, be it somewhat more often. Carpet tiles are easier to replace than wall-to-wall carpeting (ibid.). Linoleum or cork too offer sufficient resistance and are easy to maintain, and yet feel warm, comfortable and even resilient (Brand, 2010). Soft lighting, warm colours, interesting textures and thoughtfully positioned pieces of art, plants and natural objects can help to make a room cosy (Vogel, 2008).

In summary, looking at autism-friendly architecture from the outside in suggests that a number of concepts found in literature are recognizable in autistic people's autobiographies. However, it also illustrates that a single concept can be interpreted in different ways, and that concepts can reinforce but also counteract each other.

4. From the inside out

A second way to refocus the discourse about autism-friendly architecture on autistic people, is by looking at autism-friendly architecture from the inside out, *i.e.*, attending to the accounts of autistic people themselves. This allows to identify spatial aspects that are important to them beyond the concepts found in literature.

4.1 Something to hold on to

In the autobiographies, we have illustrated, the material environment appears as bringing autistic people continuity and thereby comfort in an often confusing and chaotic reality. Landschip takes this continuity to a whole new level, however. Every object entering his home immediately gets its own spot which cannot (easily) be changed afterwards. "When I move something that's already there for a while, whether or not coincidentally, I get the feeling I'm moving a domino in my life, that everything can collapse. My whole order goes missing" (Landschip & Modderman, 2004, p.48). This continuity in his environment actively facilitates certain activities. At home, it is much easier for him

to deal with other people. “There, I don’t need to be worried about surveying the whole room, so I can focus solely on the contact.” In a strange environment, this is much harder.

> “At work I have my own space, with soft lighting and a lot of my paintings. Everything there has a fixed place. (…) That way, I can control a lot of the things that surround me, but because this is continuously threatened with everything that has to do with work, I experience severe difficulties” (ibid., p.154).

In this case, the familiarity of his workspace still helps Landschip in coping with the unpredictable work environment, be it insufficiently. Dumortier (2002, p.33) found similar comfort in just one soothing object: a crane.

> “When they took me to a new place, something I didn’t like because new places were so unpredictable, they could make me accept the new place when I could see cranes out of the window. It was a familiar sight, because I could see the same cranes from my nursery. With at least one safe point, I could try to take in everything what was new. People were never safe points to me.”

Although it is much less tangible than the other design guidelines, familiarity thus seems a very important concept too. It offers a hold in the sense that everything remains ordered in the same way.

Besides needing a hold in the sense of familiarity, however, autistic people might also literally need some sort of grip. Most people do not consciously think about where they are and how their body relates to the surrounding space. Judging from the autobiographies, this is not necessarily the case for autistic people: some of them constantly need to position themselves in space. After sitting on a chair for a while, Landschip loses track of the difference between that chair and his body (Landschip & Modderman, 2004). When something unexpected or undesirable happens, this feeling

can even lead to complete 'body unawareness'. Gerland (1996, p.74) experienced this when she was locked up in a dark storage room:

> "My eyes (...) seemed to have been taken away from me, and I lost all sense of where I was inside that room. I lost my body. The up and downess of things vanished. (…) It was somehow as if I had totally changed substance, perhaps been turned into gas. A kind of dissolving."

In this kind of situations, the material environment can help. Gerland (1996, p.130) illustrates this when describing how the sudden and unpredictable sound of a moped caused her to lose all grip:

> "Up and down were suddenly in the same place and I had no sense of where my feet were. So as not to fall over or explode from inside, I would grab the fence where I was standing, pressing myself against it and holding on hard. I had to feel something that stood still, something anchored, in a world that had suddenly become totally unpredictable."

This is why Landschip prefers to cycle. "That bike is literally and figuratively something to hold on to, an anchor, a starting point through which I always know what is up and what is down in reality" (Landschip & Modderman, 2004, p.108). In these situations, when Gerland and Landschip risk to lose track of their body, the fence or bike literally offers a hold that affords them to position themselves in space.

4.2 Space as a Carrier of Meaning

The autobiographies suggest that the material environment also plays a peculiar role in how autistic people attach meaning to what is going on in the world. In the process of learning to understand and deal with the world, the material environment can take on meanings in ways we cannot predict. While trying to find the logic behind everything, Gerland (1996, p.70-1) developed various theories based on what she saw. She wondered when her mom would come and get her from school.

> “Every time my mother came, one thing was always the same: she always came into the hall. What if that meant I had to be in the hall for her to come at all? (…) I had actually never seen my mother in any other room except the hall, so I associated her appearance with the actual room, as if she just materialized in the doorway. (…) Every moment when I wasn’t being watched, I slipped out into the hall and sat on the floor there. It was a better place to be, a calmer place, where I could sit and hope to be fetched sooner.”

But the theories she developed made sense only in that specific place. When her mom wanted to leave her at another school to do some tests, she panicked completely.

> “The fact that I had learnt that I was fetched every day from playschool was not something I could transfer to this situation. It didn’t help me to work out that I would probably be fetched from this strange place too. What had happened at playschool had no relevance here” (Gerland, 1996, p.83).

This illustrates how Gerland uses some aspects of the material environment to help her understand and structure what is going on in her life. Grandin (1995, p.34) actively uses such aspects to help her face difficult moments, literally practicing the act of transition.

> “When I was graduating from high school, I would go and sit on the roof of my dormitory and (…) and think about how I would cope with leaving. It was there I discovered a little door that led to a bigger roof while my dormitory was being remodeled. The building was changing, and it was now time for me to change too. I could relate to that. I had found the symbolic key.”

> “Intellectually the door is just a symbol but on the emotional level the physical act of opening the door brings on the fears. The act of going through is my overcoming my fears and anxiety” (Grandin, 1995, p.95).

For Grandin, the material environment thus has an important symbolic dimension too. It is something she can relate to.

Judging from the autobiographies, for autistic people this symbolic dimension can become highly important. Grandin (1995, p.140) does not live for relationships with other people. Instead, she gets attached to certain projects and places.

> "The Swift plant was the place where I had some of my deepest thoughts about the meaning of life. Memories of its closing are much more devastating than any other memory. I still can't write about it without crying. My sense of identity was tied up with that plant, just as the things I had in my high school room were my identity. Then, when I went away for the summer, I did not want to pack any of my wall decorations away because I would somehow lose myself."

Gerland (1996, p.152) even feels closer to her house and garden than to her family. According to these fragments, certain spaces and objects can reinforce a sense of identity. They can reflect the deepest inner feelings.

> "I was out there in my solitude. The world was quieter then, and it looked just as deserted as it felt. That tallied. I swung on the swings in empty parks and walked the streets on my own, observing the deserted scene. I liked it when things tallied, when there was both an internal and an external emptiness."

But when a person cannot relate to the feeling a space gives him/her, it can just as well have the opposite effect.

> "I dropped out of one of my favourite dramatic arts classes because the room we met in was dark, musty, windowless and creepy – the kind of room that begs to be filled with old boxes of discards, not young students" (Willey, 1999, p.41).

Although designers may not always be aware of them, these are all meanings that are implicitly present in the material environment, as experienced by autistic people. Lee O'Neill (1999, p.20) describes her inside home, her own little world therefore as a rich world.

> "It seems that most people view this inner autistic World as dismal grey, as a dungeon without windows. To me, it is a rainbow prism. It can be a world of bright fragments, like stained glass. It is a place which many children don't wish to leave. It is a home."

Looking at autism-friendly architecture from the inside out, *i.e.*, starting from the autobiographies of autistic people themselves, thus suggests that the material environment may afford more possibilities of use and have a more prominent meaning than design guidelines might imply. It seems to offer autistic people something to hold on to, to relate to or to structure their reality.

5. Discussion and Conclusion

When designers are challenged to design an autism-friendly environment, they have at their disposal many different recommendations and guidelines. Developing these into concrete spatial interventions, however, is hard without making a generalization of "the person with autism". To what extent do the concepts advanced by these guidelines appear in autistic people's experience?

The autobiographies of six autistic adults provide us with a background to better understand the problems and possibilities addressed by the concepts underlying these guidelines, and offer a more varied image. Interpretations of the concepts can vary depending on the situation or person. Some of the concepts as such seem to reinforce or counteract each other, thereby requiring a delicate balance. Some autistic people prefer an open space because it affords having an overview, which increases predictability, and distancing oneself from others without being isolated. Others might like this space to be subdivided into several separate spaces which affords a sense of structure or reduces sensory inputs present in one room.

This illustrates that, despite the existence of design guidelines, it is still important for designers to be critical toward what is published and put it in a personal context. An autistic person is, just like any other person, someone with certain likes and dislikes. This does not mean that design guidelines cannot offer a valuable starting point. They can draw designers' attention to certain aspects which they might fail to notice otherwise, thereby assisting them in asking some important questions to future users from the very first design stage. Moreover, design guidelines may be helpful also for autistic people themselves to gain ideas as to what might work for them.

The second part of our study, however, highlighted that, for some autistic people, the material environment's affordances may extend far beyond aspects that are reducible to design guidelines. By writing their autobiographies, the six people we focused on show their world of experience and make neurotypicals attentive to aspects of space they are not always attuned to or might take for granted. Various fragments suggest that some autistic people are often in search of something to hold on to, to help them cope with the many unexpected things that can happen in everyday life. In this context a simple fence is not just a fence anymore, it becomes a safety point, something to grab when losing track of one's body. A crane can become that one familiar item, a reminder of home, which enables one to face the unknown. Trivial as these objects might seem, they are priceless on that particular moment for that particular person.

What seems to take a prominent place in the world of all six autobiographers, however, is the home. It is the one "sanctuary" where they can control as much as possible, can keep everything unchanged, without the intrusion of others. This observation resonates with findings from another study based on interviews with autistic adults about how they live and would like to live (Kinnaer et al., 2014), yet contrasts sharply with the many autistic people form whom home is a shared room in a group or nursing home, or a room in someone else's home, over which they have little or no control.

This feeling of control is not the only reason why autistic people get attached to certain objects or places, however. When they have trouble communicating and interacting with other people, the material environment seems to provide the comfort they need. It serves as a reflection of

their most inner self. It is tight up with their identity, something to relate to. Depending on their state of mind, each person can attritbute a different meaning to a particular place which can just as well be a negative one.

Finally, space also seems to provide some kind of logical framework as a starting point in trying to understand all the variables in the world. Most people can trust their inner feeling to tell them when they will be fetched from school. But what if you cannot count on this? This lack of some sort of "inner understanding" made Gerland look for explanations in the material environment.

Our explorative study is based on accounts written by six people, possibly not very representative for the entire autism spectrum. A common misunderstanding about studies like these, Bent Flyvbjerg (2006) points out, is that they cannot contribute to scientific development as one cannot generalize on the basis of a single or small number of cases. Nevertheless, he argues, the multiple wealth of details of such studies with regard to their closeness to real-life situations, enables the development of a more nuanced view of reality. And this is exactly what our study aimed at: providing a more nuanced view of what the material environment *can* actually *mean* from the point of view of people with a diagnosis on the autism spectrum.

Acknowledgments

The authors would like to thank the reviewers for their valuable comments on an earlier version of this article.

Declaration of Interest statement

This study has received funding from the Research Foundation Flanders, the European Research Council under the European Community's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement n° 201673, and from the Department of Architecture.

References

Ahrentzen, S. & Steele, K. (2009). *Advancing full spectrum housing. Arizona Board of Regents*. (Phoenix) http://stardust.asu.edu/project-archive/advancing-full-spectrum-housing/

Albrecht, G. (2003). Disability Values, Representations and Realities. (In P. Devlieger, F. Rusch, D. Pfeiffer (Eds.), *Rethinking Disability,* (pp. 27-44). Antwerp: Garant.)

APA. DSM-5. (2013). *Diagnostic and Statistical Manual of Mental Disorders*. (American Psychiatric Association)

Asperger, H. (1944). Autistic psychopathy in childhood (translation by U. Frith of Autistischen Psychopathen im Kindesalter). (In U. Frith (Ed.) (1997). *Autism and Asperger Syndrome* (pp. 37-92). Cambridge: CUP.)
Baumers, S., Heylighen, A. (2010). *Harnessing Different Dimensions of Space*. In: Langdon P., Clarkson J., Robinson P. (Eds), Designing Inclusive Interactions (pp. 13-23). London, UK: Springer-Verlag.
Beaver, C. (2011). Designing environments for children and adults on the autism spectrum. *Good Autism Practice*, *12*(1), 7-11
Bettelheim, B. (1967). *The empty fortress*. (New York: The Free Press)
Bogdashina, O. (2003). *Sensory Perceptual Issues in Autism and Asperger Syndrome*. (London: Jessica Kingsley)
Braddock, D.L., R.E. Hemp, and M.C. Rizzolo. (2008). *The State of the States in Developmental Disabilities*. 7th ed. (Washington, DC: American Association on Intellectual and Developmental Disabilities)
Brand, A. (2010). *Living in the community*. (London: Helen Hamlyn Centre, Royal College of Art)
Coolen, H. (2006). The meaning of dwellings. *Housing, Theory & Society*, *23*(4), 185-201
Delacato, C.H. (1974). *The ultimate stranger*. (Novato: Academic Therapy Publications)
Delfos, M.F. (2005). Een vreemde wereld [A strange world]. Amsterdam: uitgeverij SWP.
Dierckx de Casterle, B., Gastmans, C., Bryon, E. & Denier, Y. (2012). QUAGOL. *International Journal of Nursing Studies*, 49, 360–371
Dumortier, D. (2002). *Van een andere planeet* [From a different planet]. (Antwerp: Houtekiet)
Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219-245
Gerland, G. 1996. A real person. London: Souvenir Press; translated as: *Een echt mens: Autobiografie van een autist,* Antwerp: Houtekiet, 1998.
Gibson, J.J. (1979). *The Ecological Approach to Visual Perception*. (Hopewell, NJ: Houghton Mifflin).
Grandin, T. (1995). *Thinking in pictures and other reports from my life with autism* (New York: Doubleday)
Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child*, *2*, 217-50
Khare, R. & Mullick, A. (2009) Incorporating the behavioral dimension in designing inclusive learning environments for autism. *Archnet-International journal of architectural research*, *3*(3), 45-64
Kinnaer, M., Baumers, S., Heylighen A. (2014). How do people with autism (like to) live? In: Langdon P. et al. (Eds) *Inclusive Designing. Joining Usability, Accessibility and Inclusion*. London: Springer, pp.175-185
Klonovsky, M. (1993). Vorwort. (In: B. Sellin. *Ich will kein Inmich mehr sein*. Köln: Kiepenheuer & Witsch.)
Landschip & Modderman, L. (2004). *Dubbelklik* [Double click]. (Berchem: EPO)
Lee O'Neill, J. (1999). *Through the eyes of aliens*. (London: Jessica Kingsley)
Lynch, K. (1960). *The Image of the City*. (Cambridge: MIT Press)
Maier, J.R.A. & Fadel, G.M. (2009). An affordance-based approach to architectural theory, design, and practice. *Design Studies*, *30*(4), 393-414
Mostafa, M. (2007). An architecture for Autism. *Archnet-IJAR*, *2*(1), 189-211
Mostafa, M. (2010). Housing adaption for Adults with Autistic Spectrum Disorder. *Open house international*, *35*(1), 37-48.
Noens, I. & van Berckelaer-Onnes, I. (2004). Making sense in a fragmentary world. *Autism*, *8*(2), 197-218
Norman, D. (1999). Affordance, Conventions, and Design, *Interactions*, *6*(3), 38-42
Rajendran, G. & Mitchell, P. (2007). Cognitive theories of autism. *Developmental Review*, *27*(2), 224-260
Sánchez, P.A., Vázquez, F.S. & Serrano, L.A. (2011). Autism and the built environment. (In T. Willliams (Ed.), *Autism Spectrum Disorders* (pp. 363-380). InTech.)
Scott, I. (2009). Designing learning spaces for children on the autism spectrum, *Good autism practice*, *10* (1), 36-51
Venderbosch, S. (2008). Een plek om te leven: een onderzoek naar de leefsituatie van mensen met autisme. (Nederlandse Vereniging voor Autisme)
Vogel, C. (2008). Classroom design for living and learning with autism. *Autism Asperger's Digest*, 3, 30-40
Whitehurst, T. (2006). The impact of building design on children with autistic spectrum disorders, *Good Autism Practice*, 7(1), 31-38
Willey, L.H. (1999). *Pretending to be normal.* (London: Jessica Kingsley)
Williams, S. & Boult, M. (2009). Post Action Reviews: Property A, South Oxfordshire and Property B, West Oxfordshire (Det Norske Veritas Ltd)
Wing, L. (1997). The history of Ideas on Autism. *Autism*, 1, 13-23
Wing L. & Potter, D. (2002). The epidemiology of autistic spectrum disorders. *Mental Retardation and Developmental Disabilities Research Reviews*, *8*(3), 151-161
Wolfe J.M., Kluender K.R & Levi D.M. (2009). *Sensation & Perception*, 2nd edition (Sunderland: Sinauer Associates)

[1] Differences exist between the notion of affordance as advanced by Gibson, and that advanced by Norman (1999). However, a discussion of these differences transcends the scope of this article.